

# NGST SCIENTIST'S EXPERT ASSISTANT INTRODUCTION

- A TECHNOLOGY UNDERTAKING TO IMPROVE MISSION OPERABILITY
  - REDUCE OPERATIONS STAFFING AND MISSION LIFE-CYCLE COST
  - PROVIDE USERS SUPERIOR PROPOSAL DEFINITION TOOLS
- A JOINT EFFORT OF GSFC'S *ADVANCED ARCHITECTURES AND AUTOMATION BRANCH* AND THE ST Sci
- A PROTOTYPE *SEA* FOR HST's *ADVANCED CAMERA FOR SURVEYS* IS BEING DEVELOPED
  - IDEAL FOR PROOF-OF-CONCEPT
    - *REAL-LIFE APPLICATION*
    - *ENABLES 'ACID-TESTING' BY THE USER COMMUNITY*
- *SEA* IS A POTENTIAL ENVIRONMENT FOR NGST DESIGN TRADES
- WE INVITE AND WELCOME COMMENTS AND SUGGESTIONS
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# SEA: The Scientist's Expert Assistant

Ad-hoc Science Working Group

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## Agenda

- What is the SEA?
- What is the current process?
- How can we improve it?
- How will we accomplish this?
- Demonstration
- Challenges
- Development priorities

## What is the current process?

- NGST will be operated in service mode like HST
- Programs must be accurate, unambiguous, feasible while remaining flexible for scheduling
- Smart observing proposal development tools and up-to-date documentation are indispensable
- In evaluating HST's current process and tools, we've learned that:
  - Most Phase II proposals need modification after submission
  - Well over half of the modifications are not related to "science issues" but are technical or syntactical issues
  - Much manual and redundant data entry required
  - Responding to repetitive questions drains ST Scl staff time
  - Many problems are due to HST's complexity, but not all

## How can we improve it?

- Provide easy access to technical and reference materials
- Put user focus on science rather than technical parameters
- Provide better tools to visualize and structure the observing program
- Eliminate continual manual re-entry of information

## How will we accomplish this?

- Utilize rule-base technology
  - Science-based questions to recommend technical parameters.
  - Accommodate a range of user types: "rookie" to "expert"
- Utilize new dynamic, interactive, and visual user interfaces
  - Rapid prototyping techniques, visual tools
- Integrate the tools and modules
  - Eliminate continual manual re-entry of information
  - Context-sensitive links to reference materials and sources
  - Common interface styles for better efficiency, faster learning curve

## How will we accomplish this?

- Prototyping HST's ACS
  - Good balance of complexity, operational style
  - Nature of science objectives partially overlap with NGST
  - Will allow evaluation of SEA's effectiveness by comparison with operational ST Sci tools for ACS
- Small three year effort to investigate new ways of supporting observing proposal development
- Currently team of five: 2 GSFC contractor, 2 GSFC civil servant, 1 ST Sci. Two are full-time on SEA

## Today's Demonstration

- Initial SEA proposal browser framework
- Prototype Exposure Time Calculator (ETC)
  - supports imaging for ACS and STIS
  - uses ST ScI's "synphot" package for source and background counts
  - not yet integrated into SEA browser
- First generation Visual Target Tuner (VTT):
  - pans, zooms, selects inclusion/exclusion zones
- Preliminary expert system integration:
  - rule-based interview with minimal rule base for ACS detector and filter selection

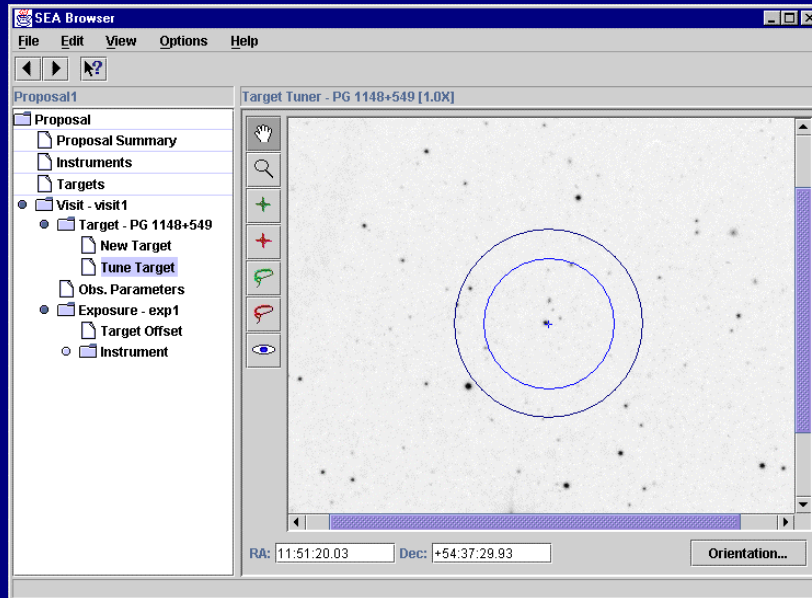


# Demonstration

## Challenges

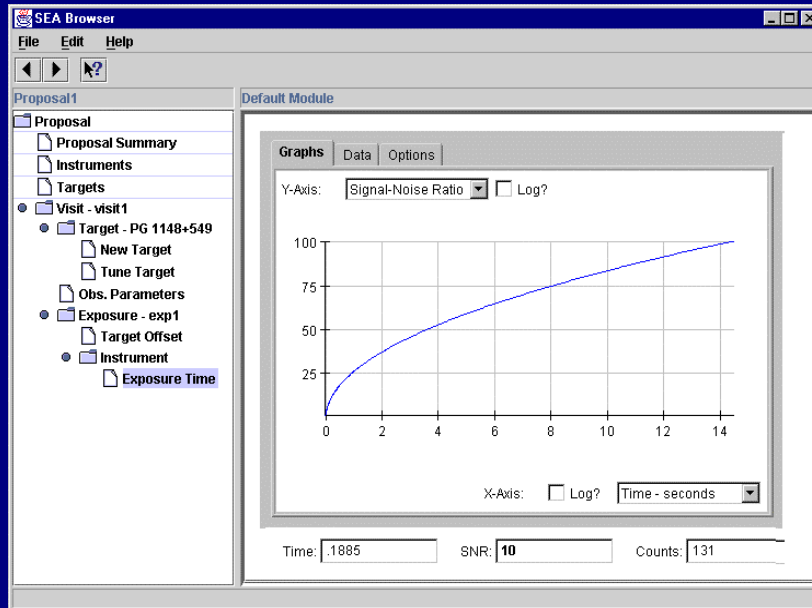
- Developing scientists' acceptance and trust of a rule-based system
- Balance between existing HST issues while looking ahead to NGST
- Adaptability to other observing platforms
  - Extensive use of object orientation to allow easy changes for different instruments, targets, and observatories
  - Potential integration and collaboration with other groups
- Keeping phase with rapidly evolving technology
  - Currently using Java 1.1 and Web-based distribution
- Developing a scientifically and technically useful help system
- Potential “spin-off” of operational products

## Development Priorities: Target Tuner



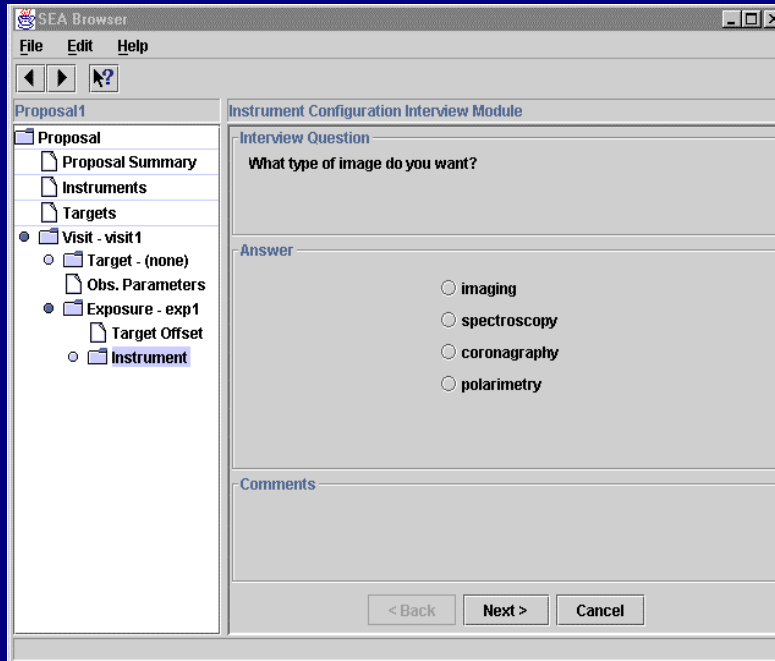
- Add additional HST apertures for complete FOV
- Model diffraction spikes, CCD bleeding
- Integrate with various catalogs to automatically retrieve information and images
- Support import and export of user-supplied images
- Integrate/merge with ETC to simulate images
- Data mining on images

# Development Priorities: Exposure Calculator



- Integrate into SEA Browser (as shown at left)
- Add support for additional spectral energy distributions and surface brightness distributions
- Adjust to provide comparison of detectors in different instruments
- Support spectroscopy

# Development Priorities: Expert Systems



- Develop and test interfaces for best question/answer format
- Expand feedback from rule base to user
- Expand rule base
  - full range of ACS configurations
  - integrate target / exposure information
  - expand use of rule base into other modules
- Visit planning
  - multiple targets and exposures

## Contacts and Additional Information

- **Lead Goddard contact: Jeremy Jones:**
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- **Lead ST Sci contact: Anuradha Koratkar:**
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- **SEA Development Web Page:**
  - <http://aaadev.gsfc.nasa.gov/NGSTProtos>
  - working page, prototype links, team presentations and papers
  - used for internal team communications

## Project Plan

- **Phase I (FY 97): analysis & initial research**
  - Research current process, establish/prioritize prototype plans
- ➔ **Phase II (FY 98): prototype “proof-of-concept” tools**
  - Design and implement covering architecture and objects
  - Implement and evaluate different interfaces options
  - 1st and 2nd generation of tool features
- **Phase III (FY 99): expand into a live test-bed**
  - Develop full operational prototype to support HST's ACS.
  - Evaluate effectiveness with existing HST production tools
- **Phase IV (FY 00): final wrap up and analysis**
  - Metrics and evaluation to see if desired gains achieved
- **Throughout: "spin-off" successful components to ST Scl or others for adaptation to production use**



## Development Strategy

- **Initial RAD prototype: Exposure Time Calculator**
  - Strawman for tool selections, initial system design
- **Proposal Browser "shell"**
  - Integrates individual modules / tools into a single system
  - "Expert" mode: form-based interface to select parameters
  - "Interview" mode: Rule-based questions guide observer
- **Individual Modules run on their own or in browser**
  - Share common object base.
  - Easily share information between modules
- **Start simple, then expand**
  - Early focus on initial architecture and integration of modules
  - Module features start simple, expand in scope and complexity
  - Initial focus is single exposure, later will expand into multiple exposures and multiple targets